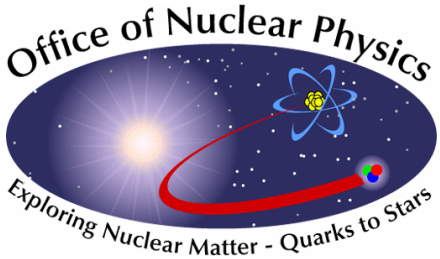

Department of Energy
Office of Nuclear Physics Report

on the

Technical, Cost, Schedule, and Management Review

of the

Electron Beam Ion Source Project

July 25-27, 2005

Executive Summary

The Department of Energy (DOE) Office of Nuclear Physics (ONP), with participation from the Office of Science for Project Assessment, held a Technical, Cost, Schedule and Management Review of the Electron Beam Ion Source (EBIS) Project at Brookhaven National Laboratory (BNL) on July 25-27, 2005.

The Relativistic Heavy Ion Collider (RHIC) at the BNL is the flagship heavy ion research facility in the Nation. Counter-rotating beams of nuclei from hydrogen to gold are accelerated to energies of hundreds of GeV and collided head on. Reaction products are analyzed in an effort to understand the dynamics of the quarks and gluons under extreme conditions of density and temperature to gain insight about the nature of matter that existed during the early Universe.

Currently, heavy ions are provided for injection into the Alternating Gradient Synchrotron (AGS) and then into RHIC by either of two 35 year old Tandem Van de Graff accelerators. BNL is proposing to construct a new pre-injector based on an EBIS to replace the aging Tandems. The principal objectives of this project are to provide a more reliable and stable source of ions, to enable the use of a wider range of nuclear species, to increase the luminosity of RHIC, and to provide for more cost-effective operations of RHIC. The EBIS-based pre-injector would also replace the Van de Graff accelerators as injector for the National Aeronautics and Space Administration (NASA) Space Radiation Laboratory (NSRL). In this context it would provide improved stability and reliability, a wider range of nuclear species, as well as the capability of switching rapidly between different species.

The accelerator improvement project is estimated to cost DOE ~ $14.8 million in actual year dollars. NASA is contributing an addition $4.5 million for a total investment of $19.3 million. DOE would be responsible for the management of the project. The project scope (DOE and NASA) would consist of an EBIS ion source, a Radio Frequency Quadrupole (RFQ) accelerator, a short Linear Accelerator, a short transport line to the Booster Accelerator, and related instrumentation.

Critical Decision-0 (Approve Mission Need) for the EBIS project was approved by Dr. Raymond L. Orbach, Director, Office of Science, on August 2, 2004. This Technical, Cost, Schedule, and Management Review was organized in preparation for Critical Decision-1 (Approve Alternate Section and Cost Range).

Summary of Primary Findings

The scientific, technical, and financial case for the construction of the EBIS-based pre-injector is affirmed. The improved stability and reliability of the ion beams injected into RHIC would increase the overall rate at which data are acquired in RHIC. Nuclear species that cannot be accelerated in the Van de Graff accelerators would also become available, broadening the scope of physics that could be addressed at RHIC and NASA

Space Radiation Laboratory (NSRL). Due to the relative simplicity of the EBIS-based system only three Full Time Equivalent (FTE) support positions would be required for its operation and maintenance, as opposed to the current twelve required for the Van de Graff accelerators, representing an annual saving of $1.5 million – $2.0 million. Moreover, the construction of the EBIS-based pre-injector would obviate the need for ~$9 million to refurbish the Van de Graff accelerators. Finally, the ability of the EBIS to switch rapidly between species would make simultaneous running of RHIC and NSRL much more efficient.

The technical design of the EBIS-based pre-injector is well developed. With pre-conceptual research and development (R&D) efforts, technical feasibility was addressed with a half-scale prototype that has been constructed and operated successfully. The design of the proposed RFQ accelerator is based upon existing operational devices. The design parameters of the proposed linear accelerator are similar to those of similar devices currently in operation. The beam transport lines are standard and present no identifiable problems. Overall, the technical risk of the project is low and the design is well-advanced.

The understanding of the costs and schedule are advanced for this stage in the project. . The project schedule is being accelerated relative to the Mission Need approved schedule, in order to realize cost savings in RHIC operations sooner and to take advantage of NASA's contributions to reduce the total cost of the project to DOE. NASA funding contributions are intended to complete the project in a more timely manner, consistent with NASA mission requirements. The proposed funding profile at the review calls for steadily increasing funding leading to a maximum in the final year of construction rather than the more conventional Gaussian shape; it was suggested that strategies be explored to ameliorate the effects of delayed procurements. The Program Office is prepared to work with the project team to try to optimize the funding profile for CD-1 approval. The proposed schedule calls for CD-2 and CD-3 to be requested in 4QFY06; it was recommended that more personnel effort be committed in order to meet this date.

The proposed management structure appears reasonable and is well integrated into the Laboratory system. However, some concern was expressed over the small fraction of each individual's time committed to the project. It was recommended that key personnel commit larger fractions and that the roles and responsibilities be more clearly defined. The necessary project documentation has been generated for CD-1, but will need to be revised to incorporate review results and reflect DOE guidance regarding management of DOE and NASA efforts. The need to clearly define the scope of NASA and DOE funds was noted. In general, the panel was impressed with the status of the project and believed it was ready to proceed to CD-1 once the minor recommendations from the review were addressed.

Contents

Introduction

On July 25-27, 2005, the Department of Energy (DOE) Office of Nuclear Physics (ONP) held a Technical, Cost, Schedule and Management Review of the Electron Beam Ion Source (EBIS) project at Brookhaven National Laboratory (BNL), with participation from the DOE Office of Science for Project Assessment. The review committee consisted of six external consultants: Mr. Claus Rode (Thomas Jefferson National Laboratory), Dr. Petr Ostroumov (Argonne National Laboratory), Dr. Rod Keller (Los Alamos National Laboratory), Professor Gene Sprouse (StonyBrook University), Mr. Steve Tkacyzk (DOE Office of Project Assessment) and Dr. Martin Stockli (Oak Ridge National Laboratory). Dr. Jehanne Simon-Gillo of the ONP chaired the review. Other agency participants included Dr. Blaine Norum and Dr. Gulshan Rai of the ONP and Barbara Corbin, Francis Cucinotta, and Frank Sulzman of the National Aeronautics and Space Administration (NASA). This review was considered necessary by ONP in order to regularly assess the overall status of the ongoing project and its readiness for request of Critical Decision-1 (CD-1, Approve Alternative Selection and Cost Range) approval.

In order to perform the review, each panel member was asked to evaluate and comment on any relevant aspect of the BNL EBIS project. However, the focus of the EBIS Technical, Cost, Schedule and Management Review was on understanding:

a. The significance and merit of this proposed accelerator improvement project;
b. The status of the technical design, including completeness of technical design and scope, feasibility and merit of technical approach;
c. The feasibility and completeness of the proposed budget and schedule, including availability of manpower;
d. The effectiveness of the proposed management structure;
e. Other issues relating to the EBIS Pre-injector.

In addition to the above, the committee was asked to evaluate drafts of project documentation that would be considered for Critical Decision 1 (CD-1): e.g., Conceptual Design Report, Preliminary Project Execution Plan (PPEP), Preliminary Hazard Analysis Report, and Preliminary Risk Assessment Report.

The review was based on formal presentations given by EBIS project staff, detailed discussions with EBIS staff, and the panel members' extensive experience. The first two days were devoted to presentations given by EBIS staff and a tour of the project site. The presentations provided an overview and response to the charge letter. The second and third days included Q&A sessions in which EBIS staff presented answers to homework assigned by the panel the previous evening. The third day consisted primarily of panel deliberations. The panel presented a closeout briefing on July 27. The detailed agenda is included in Appendix B.

DOE Recommendations

- Generate a detailed cost comparison between operation with Tandem Van de Graff accelerators and the new EBIS-based pre-injector and submit to agencies by January 31, 2006.
- Assess the project schedule and cost to determine whether the prototype EBIS could be maintained as a test stand and as a source of hot spares.
- Ensure the availability of the RF amplifier for the RFQ testing prior to the next annual review.
- Integrate the Building 930 addition proposed by the laboratory into the project schedule with appropriate milestones.
- Perform an analysis to optimize the schedule, by considering:
  - requesting that National Aeronautics and Space Administration (NASA) deduct the advanced Fiscal Year (FY) 2005 $0.5 million from FY 2008 instead of FY 2006;
  - accelerating the LINAC and dipole procurements by phase funding and
  - optimizing the contingency profile with respect to the planned obligation profile and in the context of project risks.
- Track the DOE Project Engineering Design (PED) separately from DOE Construction funds. Work with the Nuclear Physics (NP) program office to ensure that the costing of scientists on the project is in-line with current practices.
- Increase the PED manpower in FY 2006 in order to improve the probability of succeeding with the CD-2 & 3 milestones in 4QFY 2006. This is not an increase in the Total Project Cost (TPC) but only a correction to the labor profile.
- Incorporate the agreed-upon CD-4 deliverables and performance specifications into the PPEP prior to CD-1 request.
- Strengthen project management, for example by better defining the roles and responsibilities (including those of the project integrator) and increased level of effort of key personnel.
- Change the PPEP Baseline Change Control (BCC) table to address TPC.
- Implement DOE program guidance regarding management approach in project documentation.
- The project office, in coordination with the Federal Project Director (FPD), needs to proactively begin preparations for the External Independent Review (EIR) (point of reference: CFN EIR March 2004).

Merit and Significance of Project

Findings:

Brookhaven National Laboratory (BNL) proposes to build an Electron Beam Ion Source (EBIS)-based pre-injector to replace the aging Tandem Van de Graff accelerators. The EBIS-based pre-injector will affect three classes of users: 1) Relativistic Heavy Ion Collider (RHIC)/Alternating Gradient Synchrotron (AGS), 2) NSRL, and 3) users who utilize the Tandem beam under a full cost recovery agreement. The first two user classes are expected to substantially benefit from the project with regard to their productivity due to:

- availability of many more ion species because many elements do not form negative ions as needed for Tandem Van de Graff operation. In addition, new ion sources could be added to the two primary external sources, already in use on the Test EBIS;
- increased integrated luminosity for RHIC;
- faster beam switching to provide improved efficiency for simultaneous beam users; and
- significantly improved stability of the beam and somewhat improved availability after eliminating the two low energy stripper foils used with the Van de Graff accelerators.

The third user class is expected to be only slightly affected in the short term, benefiting from having two Van de Graff accelerators available to alternate with beam production until failing components will leave only one functional system in place. Continued operations of the Tandems in the outyears will depend on continued support of operations on a full cost recovery basis.

The project is expected to lead to a significant reduction in operating costs for the facility because the number of Full Time Equivalent's (FTE) could be reduced from twelve to three. The personnel cost savings are estimated at $1.5 million – $2 million per year. In addition to the savings due to reduced operating costs, the project staff affirms that the Van de Graff accelerators would need new investments of about $9 million to maintain the current performance if the EBIS-based pre-injector is not built.

The operational scenario for setup and fast switching between beams of different species is expected to be substantially simplified by the implementation of the EBIS project, with tangible benefits for DOE and NASA users.

Comments:

The merit and significance of the EBIS project is compelling and will lead to new capabilities for both DOE and NASA, as well as more efficient and cost-effective operations. Using accepted scaling laws for EBIS operation, the project group is promising beam parameters at least as good as the ones obtained with the Tandems when operating the EBIS at 10 A electron beam current; technical contingency exists with the possibility of operating at up to 20A.

The estimated costs (~$9 million) for necessary investments in the Tandems was not supported by a detailed analysis, but age, configuration, and noted operational performance indicate that a major effort would be needed. Similarly, as a rough figure, the estimated savings in operations ($1.5 million – $2.0 million per year) appear credible, but a more detailed analysis that includes actual salaries, materials, supplies, electric power, and infrastructure costs would be needed to truly quantify the savings.

Commissioning plans for how to obtain the CD-4 performance and then the projected optimum performance were not presented. The project team estimates that it will take approximately one year to reach optimum performance after the CD-4 deliverables have been met. Although detailed commissioning plans for reaching CD-4 and optimum performance are not required at this stage of the project, the agencies could benefit from receiving prior to July 2006 a strategic plan that includes a timeline for achieving intermediate and ultimate performance goals beyond the CD-4 deliverables.

A preliminary start-up plan with tasks and commissioning goals for reaching the CD-4 deliverables will need to be generated prior to CD-2.

Recommendations:

- Generate a detailed cost comparison between operation with Tandem Van de Graff accelerators and the new EBIS-based pre-injector and submit to agencies by January 31, 2006.

Technical Status

Findings:

The EBIS injector project offers higher ion flux, higher reliability, higher availability, an increased number of ion species, and a reduction in operating cost. A broad variety of ions can be produced using different primary ion sources that inject into the EBIS. The EBIS will increase the charge state of the injected ions. After the ions have reached the desired charge state the high voltage platform will be raised to about 100 kV and the ions will be extracted and injected into an RFQ. After further acceleration in a LINAC, dipole magnets will separate the charge states and inject the beam into the AGS.

Comments:

Because of successful developments of the Test EBIS at BNL, and worldwide experience with design and operation of the 101 MHz RFQs and Interdigital-H (IH) linear accelerators, the technical risk associated with the project appears low. No technical showstoppers have been identified and the technical aspects of the project appear feasible. The team that will work on this project can call upon experts within the Collider-Accelerator Division at BNL, which further reduces project risks.

For the most complete understanding of the EBIS pre-injector beam quality, an analysis of the sensitivity of beam parameters to the various errors in the accelerator components such as misalignments, manufacturing errors, and dynamic errors due to external fields, is necessary. The proposed aggressive research and development (R&D) program is well conceived to address concerns regarding required beam parameters. In performing this work, the panel believed that the project team would benefit from an internal detailed parameter list.

The panel believed the proposed diagnostics to be minimal but adequate. The addition of several phase pick-ups for the beam time-of-flight measurements may be extremely useful both for the commissioning and for the monitoring of the beam stability during the operation. The installation and testing scope and schedule have been defined and the panel thought them to be reasonable for this stage of the project.

EBIS source

Findings:

Before settling on the EBIS approach for the principal ion source, project staff investigated alternative solutions such as Electron Cyclotron Resonance and Laser ion sources, and selected the EBIS on merit.

The proposed EBIS is tailored after the half-scale prototype that successfully produces more than 50% of the ion current required to match the peak intensities of the existing

Tandem Van de Graff accelerator injector. Doubling the length of the prototype injector EBIS will double the ion output, a proven fact that is widely accepted by the ion source community. The main new features are the collector, the high current electron gun, the pulsed high voltage platform, the 6 Tesla superconducting solenoid, and the LEBT.

BNL proposes an R&D program to verify and optimize the ion beam parameters that may be affected by the new features. They plan to rapidly install the new collector, extractor, and high voltage stand in order to measure the emittance of the beam in the LEBT. The RFQ output emittance will be measured after the RFQ has been received and installed on the Test EBIS.

Comments:

The design of the EBIS is advanced and beyond CD-1 requirements. The Electron gun design is complete and seems appropriately costed for this stage of the project. Preliminary designs and cost estimates for the superconducting solenoid and for the collector have been established with United States (U.S.) vendors. The operational drift tube structure on the prototype serves as a conceptual design of the two times longer and slightly larger drift tube structure.

The LEBT is an important "switchyard" for beams into and out of the EBIS. It requires careful design to achieve high transmission efficiency and to preserve the beam emittance. Focusing by gridded lenses is apparently an effective method for low velocity, high intensity beams. However, the grid structure can generate an appreciable emittance growth of initially low-emittance beams due to transverse electric field components near the meshes. The panel thought this effect should be included in the LEBT design and simulations. The bore of the test LEBT is too small to allow proper assessment of the ion beam emittance. The design of an LEBT with adequate bore is in progress with cost estimates based on catalogue prices, vendor quotes, and engineering estimates.

The project team currently does not have any long-term plans for continued use of the Test EBIS. The panel believed that the prototype could be an asset to the program, providing improvements beyond the currently defined R&D program. In addition, it could be used to develop capabilities for new species in rapid response to NSRL requests.

Recommendations:

- Assess the project schedule and cost to determine whether the prototype EBIS developed in the R&D program could be maintained as a test stand and as a source of hot spares.

RFQ

Findings:

The design of the RFQ is based on designs of existing RFQ's at GSI and Conseil European pour la Recherché Nucleaire (European Organization for Nuclear Research, CERN). A detailed design of the RFQ system is available and essentially ready for procurement. To finalize the RFQ design, more beam dynamics simulations including space charge effects on dynamics of multiple charge state ion beam will be performed. The panel believed that the proposed RFQ design meets the needs of the EBIS project.

Commissioning and testing of the RFQ using the Test EBIS beam are proposed by the project team. However, in the current schedule, delivery of the first 101 MHz RF amplifier does not match to the RFQ testing schedule and could lead to scheduling problems.

Comments:

The project team proposes that two main structural components of the project, the RFQ and the IH linac, be provided by highly-experienced teams in the field. This should lower the technical risk; the remaining risks are related to the cost and schedule.

The panel noted that end-to-end simulations of the LEBT-RFQ-MEBT-LINAC systems are necessary prior to the finalization of the RFQ design. They also stated that the design of the RF and Control systems is well advanced for this stage of the project.

The RFQ and IH-cavity would operate at high RF field levels, with voltages reaching ~400 kV in the accelerating gaps. Although it is expected that the system would operate at a very low duty cycle, some X-ray shielding may be necessary.

Reviewers pointed out that the possibility of splitting ~1-2% of RF power through a directional coupler from the 400 kW RF amplifiers to feed the buncher and debuncher could be considered. This scheme could save about ~$100 thousand on low-power amplifiers for the bunchers.

Recommendations:

- Ensure the availability of the RF amplifier for the RFQ testing prior to the FY 2006 annual review.

Linac

Findings:

The proposed Interdigital-H (IH) linac with internal electromagnetic focusing is similar in its design parameters to linacs currently operating at CERN and elsewhere. A supplier has been located that has successfully produced other similar linacs.

Comments:

Modifying the basic design of the IH linac to include electrostatic focusing elements could simplify operation with multiple beams. The panel suggested that effort be made soon to weigh the ramifications of this design change in order not to delay the definitive selection to the point where the entire project would be delayed.

The panel believed the proposed budget (including the estimated contingency) is appropriate, the schedule realistic, and the required manpower available.

Recommendations:

- None

MEBT-HEBT

Findings:

The MEBT matches the output of the RFQ into the LINAC and provides diagnostic elements. The reviewers that it had been modeled with appropriate computer codes.

The HEBT transports the output of the LINAC to the Booster Accelerator and provides charge state selection before injection into the Booster Accelerator.

Comments:

The current MEBT and HEBT designs appear to satisfy all of the technical requirements. The proposed use of existing solid core magnets may not be ideal for beam switching applications. However, the available control systems that allow for a function generator to vary the current in time can facilitate the use of these magnets. Reviewers suggested that field variations due to eddy currents should be measured.

In high intensity beams, variation of beam current during the pulse can impact matching conditions. As a result, the effective emittance of the beam can be higher and cause some beam losses along the accelerator and transport lines.

The survey and alignment effort appears to be well prepared, the instrumentation and evaluation software are ready, and the associated costs are well understood.

The panel did not identify any budget, schedule, or manpower issues with either the MEBT or the HEBT.

Recommendations:

- None

Facility Modifications

Findings:

The proposed facility modifications within the project scope consist of a beam access port and electric power modifications. A linac "extension" to BNL Building 930 with an estimated cost of ~ $750 thousand would be needed for the project. It is, however, outside of the scope of the EBIS project. Funding would come from the State of New York.

Comments:

The facility modifications are similar to those in previous projects and are not considered a significant risk to budget or schedule.

The project team needs to have a strong interface with the building extension project. Milestones such as approval of building specifications by the project manager and the schedule for occupancy of the building with all systems (HVAC, safety, etc.) functioning should be defined.

Recommendations:

- The Building 930 addition proposed by the laboratory should be fully integrated into the project schedule with appropriate milestones.

Budget and Schedule

Findings:

The estimated overall project cost is $19.3 million in as-spent dollars. NASA will contribute $4.5 million, lowering the DOE total project cost (TPC) to $14.8 million. The project contingency is 24%. The escalation rates used are the standard DOE escalation rates. The currently proposed funding profile is a ramp function vs. the customary bell-shaped curve (Fiscal Year 2005-2008 (FY05-08): $1.2, 3.1, 6.5, & 8.5 million).

The proposed plan calls for the following project staffing (FTEs) in FY06-09: 4, 10, 12, & 4 (excluding R&D). No new hires are planned to implement the project. Largely based on RHIC and Spallation Neutron Source (SNS) experience, it is estimated that 40% of the project cost would be for labor and 60% for materials. The bases of estimate for the material costs are:

- 12% Catalog Price
- 48% Vendor Quote
- 29% Historic Cost
- 11% Engineering Judgment

CD-2 and 3 are both planned for fourth quarter fiscal year 2006 (4QFY06).

Comments:

The Laboratory and Division management acknowledge that this project is critical for the laboratory's future and, therefore, that the project can be expected to receive the required priority.

The project appears cost effective and highly leveraged with the use of the high-level of expertise among BNL staff. The completion of the SNS project at BNL provides adequate and experienced manpower for the EBIS project. However, the planned manpower levels are somewhat low, particularly in FY 2006. The schedule leading to CD-4 overall is reasonable, but the near term CD-2 and CD-3 schedule is aggressive. The 4 FTEs planned for FY 2006 must complete the detailed design, complete the project documentation, prepare for the External Independent Review (EIR), and place at least two major NASA procurements. Increasing the Project Engineering Design (PED) manpower in FY06 (perhaps doubling) would improve the probability of succeeding with the CD-2 & CD-3 milestones in 4QFY 2006 and would better correlate with the projected PED funding profile.

The presented obligation profile would delay some procurements to early FY 2008. The relatively high level of funding in FY 2008 is offset by there being no funding at all in FY 2009. The first half of FY 2009 is to be funded from the FY 2008 Budget at Completion (BAC) carryover and the latter half from accumulated contingency.

Scientists typically are not costed to the Total Estimated Cost's (TEC) of NP or High Energy Physics (HEP) projects, unless they are performing project management duties or performing as an engineer or technician. The costing of scientists needs to be standardized to match other NP and HEP projects.

The estimated overall project cost of $19.3 million, including 24% contingency, appears reasonable based on the level of detail in the cost estimates. A number of minor issues have been identified that could impact the costs both negatively and positively, including proper costing of scientists, realistic escalation rates, and a tax on the NASA contribution.

Recommendations:

- Perform an analysis to optimize the schedule, by considering:
  - requesting that NASA deduct the advanced FY 2005 $0.5 million from FY 2008 instead of FY 2006;
  - accelerating the LINAC and dipole procurements by phase funding and
  - optimizing the contingency profile with respect to the planned obligation profile and in the context of project risks.

- Track the DOE PED separately from DOE Construction funds.

- Work with the NP program office to ensure that the costing of scientists on the project is in-line with current practices.

- Increase the PED manpower in FY 2006 in order to improve the probability of succeeding with the CD-2 & 3 milestones in 4QFY 2006. This is not an increase in the TPC but only a correction to the labor profile.

Management and Project Documentation

Management Structure

Findings:

The project is to be funded jointly by DOE and NASA; management of the project will be the responsibility of the DOE. The detailed allocation of the DOE and NASA contributions currently are not defined sufficiently in the draft project documentation to meet DOE requirements.

The Preliminary Project Execution Plan (PPEP) includes an analysis of alternatives, a project management structure, a Baseline Change Control (BCC) process which addresses the Total Estimated Cost (TEC), and the proposed functional requirements and CD-4 deliverables. The project is organized in a Work Breakdown Structure (WBS) for purposes of planning, managing, and reporting activities. An integrated project team has been assembled which currently does not include representation from Contracts and Procurements. Project controls are being established for baseline cost and schedule development as well as progress reporting.

The project will be required to undergo an EIR from Office of Engineering and Construction Management (OECM) within the next year (required for CD-2). No explicit preparations have been made to date.

Comments:

The scope of work to be covered by the different agency contributions needs to be clarified in the project documentation. The Program Office has provided guidance following consultation with DOE OECM.

Regarding the PPEP, the Alternative Analysis appears reasonable. The management structure appears reasonable overall and integrated with laboratory management structure. There are, however, some minor concerns (e.g., part time BNL Project Manager/Project Services, adequacy of project integration, reliance on procurement and other functions funded from laboratory overhead). These represent not so much a potential cost impact to the project as much as a need to clarify roles, responsibilities, and accountability. The BCC needs to address the TPC per DOE requirements. CD-4 deliverables and performance requirements need to be more clearly defined and be achievable. Discussions at the review resulted in a table of agreed-upon CD-4 deliverables, as well as planned optimum performance specifications. The WBS appears reasonable and consistent with the discrete increments of project work. The WBS dictionary is comprehensive. Project Management Control System appears to be appropriate for this size project.

The cost books provided at the review provided good backup information for the cost estimates, but were not traditional summary level cost books.

The project is advanced for this stage of development and will be ready to proceed to CD-1 once minor issues identified at this review have been addressed. The EIRs required prior to CD-1 have a history or requiring significant effort on the part of the project office as well as the site office and must be considered when planning manpower allocation.

Recommendations:

- Incorporate the agreed-upon CD-4 deliverables and performance specifications into the PPEP prior to the CD-1 request.

- Strengthen the project management by, for example, better defining the roles and responsibilities (including those of the project integrator) and increasing the level of effort of key personnel.

- Change the PPEP BCC table to address the TPC.

- Implement DOE program guidance regarding management approach in the project documentation.

- The project office, in coordination with the Federal Project Director, needs to proactively begin preparations for the EIR (point of reference: CFN EIR March 2004).

Preliminary Risk Assessment

Findings:

The project has prepared a preliminary assessment of the risks associated with the project and a risk based contingency assessment process has been developed.

Comments:

The risk based contingency methodology is appropriate for this project and is expected to be complete to support the project baseline at CD-2.

Recommendations:

- None

ES&H and Preliminary Hazard Analysis

Findings:

A Preliminary Hazard Analysis has been prepared. Further analysis of several hazards was indicated. Actions required by the National Environmental Policy Act (NEPA) have been completed. The Safety Assessment Document (SAD) is to be completed by 1Q 2008.

Comments:

Environmental aspects and potential hazards have been identified and plans are in place to adequately address all issues.

The final integrated project schedule should include appropriate safety approval milestones.

Recommendations:

- None

Appendix A: Charge Memorandum

Thank you for agreeing to participate as a review committee member for the first annual Technical, Cost, Schedule and Management Review of the Electron Beam Ion Source (EBIS) Pre-injector for the Relativistic Heavy Ion Collider (RHIC) at the Brookhaven National Laboratory (BNL). This review is being organized with input and participation from the Department of Energy (DOE) Office of Project Assessment and is scheduled for July 25-27, 2005 at Upton, New York. A list of the members of the Review Panel and anticipated DOE and NASA participants is enclosed.

BNL is proposing to construct an EBIS-based pre-injector to provide heavy ions for injection into RHIC. The accelerator improvement project is estimated to cost ~ $19 million in actual year dollars. This would be a joint DOE-NASA undertaking with DOE responsible for the management of the project. The pre-injector would consist of an EBIS ion source, a Radio Frequency Quadrupole (RFQ) accelerator, a short Linear Accelerator, a short transport line to the Booster Accelerator, and related instrumentation.

Each committee member is asked to assess all aspects of the project's conceptual design and associated plans -- technical, cost, schedule, management, and environment, safety and health. The following main topics will be considered at the review:

- The significance and merit of this proposed accelerator improvement project;
- The status of the technical design, including completeness of technical design and scope, feasibility and merit of technical approach;
- The feasibility and completeness of the proposed budget and schedule, including availability of manpower;
- The effectiveness of the proposed management structure;
- Other issues relating to the EBIS Pre-injector.

In addition to the above, the committee is asked to evaluate drafts of project documentation that will be considered for Critical Decision 1 (CD-1, Approve Alternative Selection and Cost Range), e.g., Conceptual Design Report, Preliminary Project Execution Plan, Preliminary Hazard Analysis Report, and Preliminary Risk Assessment Report.

Each committee member is asked to review these aspects of the proposed EBIS and write an individual "letter report" on his/her findings. These "letter reports" will be due at DOE two weeks after completion of the review. Acting as Chair, I will accumulate the "letter reports" and compose a final summary report based on the information in the letters.

The Laboratory has been asked to provide relevant background materials prior to the review. This documentation, along with a current agenda, will be distributed in the near future.

The first day of the Review will consist of presentations by the laboratory and executive sessions. The second day will include presentations and break-out sessions. The third day

will be used for an executive session, preliminary report writing, and a brief close-out. Preliminary findings, comments and recommendations will be presented at the close-out.

If you have any questions about the review, please contact Dr. Blaine Norum at (301)-903-4398, or E-mail: Blaine.Norum@science.doe.gov. If you have any questions regarding local travel, lodging, or other local logistics, please contact Sandy Asselta at BNL at (631)-344-4550 or E-mail: sandylee@bnl.gov. I greatly appreciate your willingness to assist us in this review. I look forward to very informative and stimulating discussions at BNL.

Sincerely,

Jehanne Simon-Gillo
Acting Director
Facilities and Project Management Division
Office of Nuclear Physics

Appendix B: Agenda

Monday, July 25, 2005

10:00 Executive Session – Charge ..... M. Butler

10:30 Welcome/Introduction ..... P. Chaudhari / D. Lowenstein

10:45 Project Overview ..... J. Alessi

11:45 Technical Design, Feasibility (EBIS) ..... E. Beebe

12:30 Lunch

13:30 Cost /Schedule/Manpower ..... K. Mirabella

14:00 Break

14:15 ESSH..... E. Lessard

14:45 Management ..... J. Alessi

15:30 Accelerator and Transport..... D. Raparia

16:20 Executive Session

18:00 Homework Assignments

19:00 Dinner

Tuesday, July 26, 2005

08:30 Executive Session

09:00 Assignment Reports

09:30 Tour and Break

10:45 1.1 Structural Components – EBIS, LEBT, external sources ..... A. Pikin

11:15 1.1 Structural Components – RFQ, Linac, Bunchers ..... J. Alessi

11:30 1.4 Magnet Systems..... J. Ritter

11:45 1.5 Power Supplies ..... R. Lambiase

12:00 Lunch

13:00 Linac Building Extension..... A. McNerney

13:15 1.6 RF System ..... A. Zaltsman

13:30 1.2 Controls ..... D. Barton

13:45 1.3 Diagnostics System..... M. Wilinski

14:00 Break

14:30 1.7 Vacuum System ..... M. Mapes

14:45 1.8 Cooling System.....R. Grandinetti

15:00 1.9 Facility Modifications.....A. Pendzick

15:15 1.10 Installation and Commissioning.....L. Snydstrup

15:45 Executive Session

17:30 Homework Assignments

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08:30 Assignment Reports

09:30 Report Writing

14:00 Closeout

14:30 Adjourn